

REMARKS

Comments by the Examiner in connection with the restriction requirement in the Office Action mailed December 21, 2006, on page 2 of the Office Action mailed April 16, 2007, are noted. Withdrawn claims 6, 9, 16 and 27 are being maintained in the above-identified application, without prejudice to the filing of a Divisional application directed to the subject matter thereof.

The objection to the drawings under 37 CFR 1.83(a), set forth on pages 2 and 3 of the Office Action mailed April 16, 2007, is respectfully traversed. The Examiner's attention is respectfully directed to Fig. 15, showing a plurality of layers of micro pillars, recited in claim 19. Thus, it is respectfully submitted that the drawings show that feature of the invention specified in claim 19, and that 37 CFR 1.83(a) is satisfied in connection with the subject matter of claim 19. Moreover, in view of Fig. 15, it is respectfully submitted that a new/replacement sheet is not needed, with respect to the subject matter of claim 19.

Applicants are amending their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended claim 19 to recite that the functioning substrate has a plurality of layers of the micro pillars, each layer being supported on a base member, the plurality of layers being stacked on and bonded to a supporting member. In addition, Applicants have amended claim 24 to recite therein the subject matter of claim 12; that is, to recite that the thermoplastic organic polymer is modified on the surface of the columnar micro pillars.

Moreover, Applicants are adding new claims 28-31 to the application. Claim 28, dependent on claim 11, recites that the micro pillar group is a group of micro pillars formed by pressing a mold, having pits, against the material such that

the material is pressed into the pits, and separating the mold therefrom, thereby to elongate the columnar micro pillars of the matrix surface. Note, for example, previously considered claim 24. Claim 29 recites the same subject matter expressly set forth in claim 12, but is dependent on claim 28. Claims 30 and 31, dependent respectively on claims 29 and 28, recite that material of the group of micro pillars includes an organic polymer that elongates when the mold, having the material of the group of micro pillars therein, is separated therefrom. In connection with claims 30 and 31, note, e.g., the sole full paragraph on page 10, and the paragraph bridging pages 10 and 11, of Applicants' specification.

Applicants note the objection to claims 18 and 19, set forth on page 3 of the Office Action mailed April 16, 2007. Claim 18 has been cancelled without prejudice or disclaimer; accordingly, the objection in connection therewith is moot. Claim 19 has been amended to recite that the functioning substrate has a plurality of layers, each layer of micro pillars being supported on a base member, with the plurality of layers being stacked on and bonded to a supporting member. Note, for example, Fig. 15, and the corresponding description in connection therewith, for example, in the last paragraph on page 49 of Applicants' specification. It is respectfully submitted that claim 19 as presently amended is consistent with Applicants' original disclosure.

The objection to claims 21 and 22 under 37 CFR 1.75(c), as being of improper dependent form, the Examiner contending that the recitations in claims 21 and 22 "are already recited in claim 24", is respectfully traversed, in view of the following. Thus, note that claim 24 defines the at least one group of columnar micro pillars in terms of how the at least one group is formed, reciting the separation of the mold to elongate the columnar micro pillars from the matrix. Thus, claim 24 defines the

columnar micro pillars relative to the matrix. Claim 20 defines a length of each of the columnar micro pillars relative to a depth of respective pits of the mold. It is respectfully submitted that claim 20 is not redundant with claim 24, as claim 20 defines length of the columnar micro pillars relative to depths of the pits of the mold. It is respectfully submitted that claim 21 further defines the subject matter of claim 24, reciting that the pillars are stretched upon removal of the mold to form the columnar micro pillars. Compare with claim 24, reciting elongation of the columnar micro pillars.

Thus, as seen the foregoing, it is respectfully submitted that claims 20 and 21 are not are redundant with respect to claim 24, and that claims 20 and 21 satisfy requirements of 37 CFR 1.75(c) in that they further limit the subject matter of a previous claim.

The provisional obviousness-type double patenting rejection set forth on page 4 of the Office Action mailed April 16, 2007, is noted. Submitted herewith is a Terminal Disclaimer in the above-identified application, with respect to any U.S. Patent issuing from copending Application No. 10/985,972, filed November 12, 2004. It is respectfully submitted that this Terminal Disclaimer satisfies requirements of 37 CFR 1.321(c); and that, accordingly, the provisional obviousness-type double patenting rejection is moot.

The enclosed Terminal Disclaimer is being submitted so as to facilitate proceedings in connection with the above-identified application. It is respectfully submitted that the filing of this Terminal Disclaimer does not constitute an admission as to the propriety of, or agreement with, the provisional obviousness-type double patenting rejection; and does not constitute agreement with, or an admission as to the propriety of, arguments made by the Examiner in connection with the

obviousness-type double patenting rejection.

Applicants respectfully traverse the rejection of claims 14 and 19 under the second paragraph of 35 USC 112, set forth on page 5 of the Office Action mailed April 16, 2007, especially insofar as this rejection is applicable to the claims as presently amended. Thus, claim 14 has been amended to recite “an” upper surface constituting the flow path. In view of this amendment of claim 14, it is respectfully submitted that the rejection of claim 14, on the basis that there is insufficient antecedent basis for “the upper substrate” in the claim, is moot.

Claim 19 has been amended to recite that the functioning substrate has a plurality of layers of the micro pillars, each layer being supported on a base member, with the plurality of layers being stacked on and bonded to a supporting member, consistent with the disclosure in, e.g., Fig. 15. It is respectfully submitted that claim 19 as presently amended sufficiently defines the metes and bounds of the present invention such that one of ordinary skill in the art would know whether any functioning substrate fell within or outside the scope of the present claims. Under the present circumstances, it is respectfully submitted that the second paragraph of 35 USC 112, requires nothing more. See In re Moore, 169 USPQ 236 (CCPA 1971).

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the prior art applied by the Examiner in rejecting claims in the Office Action mailed April 16, 2007, that is, the teachings of the U.S. patent to Agrawal, et al., No. 7,195,872, under the provisions of 35 USC 102 and 35 USC 103.

It is respectfully submitted that this reference as applied by the Examiner would have neither taught nor would have suggested such a functioning substrate as

in the present claims, having, inter alia, the group of columnar micro pillars of thermoplastic organic polymer, wherein the columnar micro pillars are columnar micro pillars formed by pressing a mold, having pits, against the first matrix (from which the columnar micro pillars are elongated) such that material of the columnar micro pillars are pressed into the pits, and separating the mold therefrom, thereby to elongate the columnar micro pillars from the matrix, and wherein the thermoplastic organic polymer is modified on the surface of the columnar micro pillars. See claim 24. Note also claim 30.

Furthermore, it is respectfully submitted that the applied reference would have neither taught nor would have suggested such micro biochip as in the present claims, having the recited group of micro pillars, with the micro pillars having the equivalent diameter, height and aspect ratio as in claim 11, and, moreover, wherein the organic polymer included as material of the group of micro pillars is modified on the surface of the micro pillars (see claim 12).

In addition, it is respectfully submitted that the teachings of this applied reference does not disclose, nor would have suggested, such functioning substrate, or such micro biochip, as in the present claims, having features as discussed previously, and, moreover, wherein the (thermoplastic) organic polymer of the group of micro pillars is a (thermoplastic) organic polymer that elongates when the mold, having the organic polymer or material in the pits thereof, is separated therefrom. See claim 22, as well as claims 30 and 31.

Furthermore, it is respectfully submitted that the teachings of the applied reference would have neither disclosed nor would have suggested the other features of the present invention as in the remaining, dependent claims being considered on the merits, having features of claims as discussed previously, and additionally

including (but not limited to) wherein the group of columnar micro pillars is self-supporting (note claim 2); and/or aspect ratio of the columnar micro pillars (see claim 3); and/or wherein the equivalent diameter of the tip end of the columnar micro pillars is smaller than that of the bottom surface (see claim 4), or wherein the pillars have a portion tapering from the root in contact with the first matrix toward the tip end (see claim 5), and/or wherein at least the surface of the micro pillars is made of a substance mainly composed of a water-repellant and/or oil-repellant organic polymer (see claim 7), or wherein at least a part of the surface of the group of columnar micro pillars is provided with metal plating (see claim 8) and/or the plurality of layers of the micro pillars (see claim 19); and/or wherein each of the micro pillars has a length greater than a depth of respective pits of a mold used in forming the micro pillars (see claim 20); and/or wherein the group of micro pillars are columnar micro pillars formed by pressing a mold having pits against the organic polymer, the organic polymer entering the pits so as to form pillars, and removing the mold, with the pillars being stretched upon removal of the mold to form the columnar micro pillars (see claim 21).

The invention as claimed in the above-identified application is directed to a functioning substrate and micro biochip, being equipped with micro pillar groups.

As described on pages 1-3 of Applicants' specification, various types of nano-pillar structure have been proposed, formed by various techniques. For example, a nano-silicon pillar group using a metallic cluster such as iron, gold and silver as a self-forming nucleus of a plasma etching mask has been proposed. Another technique forms resin-made micro pillars, in which the surface of a silicon substrate is coated with a polymethyl methacrylate film; a mask of a silicon substrate is placed on the film through a spacer, and then heating is performed, in order to form micro

pillars on the polymethyl methacrylate film.

However, previously proposed structures involved certain problems. For example, formation of the nano-pillars as described in the foregoing is restricted to inorganic materials, and requires a dry etching method. Moreover, in forming the polymethyl methacrylate micro pillars, it has been difficult to control the position, the diameter and height of the micro pillars freely.

Against this background, Applicants provide structure that can easily and effectively be provided, and which can provide accurate and precise micro pillars made of plastic material. Applicants have found that by forming the pillars of thermoplastic polymer material, and forming the micro pillars using a mold with pits, the micro pillars being elongated when removing the mold from the micro pillars, objective of the present invention are achieved. That is, the micro pillars can be formed with high aspect ratio and high precision, and can be made of thermoplastic polymer material, thus forming a structure which is relatively inexpensive and which can be formed by an easy and relatively inexpensive method.

Agrawal, et al. discloses a substrate having a high surface area for use as a microarray device, wherein structural micro features are formed on a surface of a substrate that increases surface area and accessibility thereto. The described substrate includes a plurality of adjacent microfeatures on a surface of a substrate arranged in spatially discrete regions to provide a texture on the surface, the textured surface providing an increase in surface area as compared to a non-textured surface. This patent discloses the substrate may include a material selected from the group consisting of glass, a ceramic, a metal, a non-metal and a polymer; and that the microfeatures may include a material that is different from the material of the substrate, this material being selected from a group consisting of glass, a ceramic, a

metal, a non-metal, an inorganic oxide and a polymer. This patent discloses that a plurality of microfeatures may include a pit, a trench, a pillar, a cone, a wall, a micro-rod, a tube, a channel or a combination thereof. Note column 4, lines 41-58. See also column 4, lines 63-67, describing aspect ratios of the microfeatures, among other aspects thereof. In column 5, lines 12-18, this patent discloses that the surface further includes a plurality of microstructures, which may comprise a pit, a trench, a pillar, a cone, a wall, a micro-rod, a tube, a channel or a combination thereof. As to what is meant by "microfeatures" and "microstructures", note column 11, lines 19-36 of Agrawal, et al. See also column 6, lines 46-54; and from column 6, line 60 through column 7, line 3. See also column 15, lines 12-18 and 53-57; and column 16, lines 56-60. Note, further, column 17, lines 7-14, 24, 25 and 43-46.

It is respectfully submitted that Agrawal, et al. discloses a large variety of different materials for the substrate and microfeatures, only generally referring to polymers, and disclosing etching or embossing for forming the microfeatures. It is respectfully submitted that this reference does not disclose, nor would have suggested, the functioning substrate as in the present claims, having the columnar micro pillars which are micro pillars formed as in the present claims, including elongation of the micro pillars from the matrix and other features thereof as discussed in the foregoing.

Moreover, noting that Agrawal, et al. discloses a maximum of the aspect ratio of less than about 10, with a height of about 0.1 to about 100 microns for each of the plurality of microfeatures, it is respectfully submitted that this would have neither disclosed nor would have suggested the aspect ratio of four or more, and, in particular, the equivalent diameter of the micro pillar group and height, as in the various of present claims.

It is emphasized that Agrawal, et al. discloses etching or embossing, and it is respectfully submitted that this patent does not disclose the elongation/stretching of the micro pillar material as in the present claims, and advantages thereof, as discussed in the foregoing.

Comments by the Examiner in the first paragraph on page 7 of the Office Action mailed April 16, 2007, are noted. It must be emphasized that where the processing forms a different structure, such processing must be considered in determining patentability. See In re Luck, 177 USPQ 523, 525 (CCPA 1973). Herein with the unique combination of material used and processing including use of the mold with pits, providing elongation/stretching of the material in forming the micro pillars, it is respectfully submitted that a different product is formed than that of Agrawal, et al. and that the present structure has advantages as discussed in the foregoing.

The additional comments by the Examiner in the second paragraph on page 7 of the Office Action mailed April 16, 2007, are noted. While Agrawal, et al. may disclose compression molding, it is respectfully submitted that the Examiner has not even alleged that Agrawal, et al. would have disclosed the elongation/stretching as in the present invention, or advantages achieved thereby.

Furthermore, noting that the Examiner has not set forth a basis for anticipation or obviousness of previously considered claim 12, such aspect of the present invention, in claims 12 and 29 as well as in claim 24, would not have been disclosed or suggested by the teachings of the applied reference.

In connection with the rejection of claim 18 set forth on page 8 of the Office Action mailed April 16, 2007, it is noted that claim 18 has been cancelled without prejudice or disclaimer; and, thus, rejection thereof is moot.

In view of the foregoing comments and amendments, and further in view of the presently submitted Terminal Disclaimer, reconsideration and allowance of all claims presently in the application are respectfully requested.

To the extent necessary, Applicants hereby petition for an extension of time under 37 CFR 1.136. Kindly charge any shortage of fees due in connection with the filing of this paper, including any extension of time fees, to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Account No. 01-2135 (No. 520.43241X00), and please credit any overpayments to such Deposit Account.

Respectfully submitted,

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